

**Attachment 4**  
**Protocol for Evaluating Exhaust Gas Recirculation and  
Reduced Nox Burners on a Reheat Furnace**

As required by this Consent Decree, Nucor will evaluate the use of exhaust gas recirculation and reduced NOx burners (EGR/RNB) on the new NN2 reheat furnace to be installed at their Norfolk facility. EGR/RNB is expected to significantly reduce Nitrogen Oxide (NOx) emissions from reheat furnaces. This protocol presents the approach Nucor will use for this pilot study. Any provisions of this protocol, including schedule, may be modified by the written agreement of the United States and Nucor at any time.

**A. Approach for Norfolk Facility**

Prior to initiating any testing program, Nucor will submit a detailed testing and monitoring program to EPA for review and approval. The plan will include a description of the test methods to be used, a discussion of test procedures, and a description of the sampling locations.

**1. Initial Testing**

The NN2 reheat furnace is a new furnace that will be installed with EGR and RNB. After installation and optimization of the furnace, Nucor will monitor emissions from the furnace for a period of 5 days with the EGR system bypassed. This will provide EPA with a NOx emissions value for the furnace when it is operated with reduced NOx burners. During the test period, Nucor will monitor and record NOx, Carbon Monoxide (CO), Carbon Dioxide (CO2), Oxygen (O2), and Sulfur Dioxide (SO2) emissions from the furnace. Nucor will also determine the exhaust gas temperature, velocity of the furnace exhaust gas, the molecular weight of the exhaust gas, and the moisture content of the exhaust gas in accordance with EPA methods 2, 3A, and 4.

**2. Evaluation of EGR/RNB**

After the initial testing period, Nucor will begin evaluating the impact of the EGR/RNB system on NOx emissions. Nucor will use continuous emissions monitors to monitor and NOx, CO, CO2, O2, and Sulfur Oxide (SOx) emissions from the furnace. Nucor will monitor emissions at the maximum exhaust

gas flow rate for the furnace, an intermediate flow rate, and the minimum flow rate of the furnace. This will allow Nucor to determine the effectiveness of the EGR/RNB system under a range of operating conditions. Nucor will also determine the exhaust gas temperature, the velocity of the furnace exhaust gas, the molecular weight of the exhaust gas, and the moisture of the exhaust gas in accordance with EPA methods 2, 3A, and 4.

### 3. Report to EPA

Nucor will prepare a report for EPA that will include the results of the evaluation test program, any problems encountered in operating the furnace that might be associated with the EGR/RNB system, and the cost effectiveness of the EGR/RNB system based on the results of the evaluation test, the capital cost of the system, and actual operation and maintenance costs of the system. Nucor will submit a copy of all electronic data with the report.

### 4. Schedule

Table 1 presents the schedule for the EGR/RNB pilot study at the Norfolk facility.

**TABLE 1. SCHEDULE FOR EGR/RNB PILOT STUDY AT NORFOLK**

ACTIVITY	PROJECTED DATE
Begin Installation of reheat furnace	3 months after permit issuance
Submit test plan to EPA	30 days before testing begins
Evaluation testing of EGR/RNB system	45 days after full operation commences
Report to EPA	60 days after testing completed

## **B. Evaluation of Control Technologies for Other Nucor Reheat Furnaces**

Nucor has committed to installing either EGR/RNB or selective catalytic reduction (SCR) on its remaining reheat furnaces. In conjunction with the EGR/RNB pilot study at the Norfolk facility, Nucor is also conducting a SCR pilot study on a reheat furnace at its facility located in Darlington, South Carolina and on another reheat furnace to be identified later. At the conclusion of these pilot studies, Nucor will prepare a report for EPA that presents a comparison of these two technologies. The comparison will include an analysis of the NOx control efficiency of each technology, the cost effectiveness of each technology, and an analysis of other environmental and energy impacts associated with each technology.

Nucor will include in the report a discussion of the factors that should be considered in selecting the most appropriate technology for a given furnace. These factors are expected to include furnace design, burner design, baseline NOx emissions, configuration of the rolling mill, and the relative amounts of time the furnace is operated at maximum and minimum flow rates.